RESEARCH PLAN

ON

DESIGN OF MULTIBAND AND ULTRA-WIDE BAND ANTENNAS FOR MOBILE COMMUNICATION

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INTRODUCTION

A microstrip or patch antenna is a low profile antenna that has a number of advantages over other antennas it is lightweight, inexpensive, and easy to integrate with accompanying electronics. While the antenna can be 3D in structure (wrapped around an object, for example), the elements are usually flat, hence their other name, planar antennas.

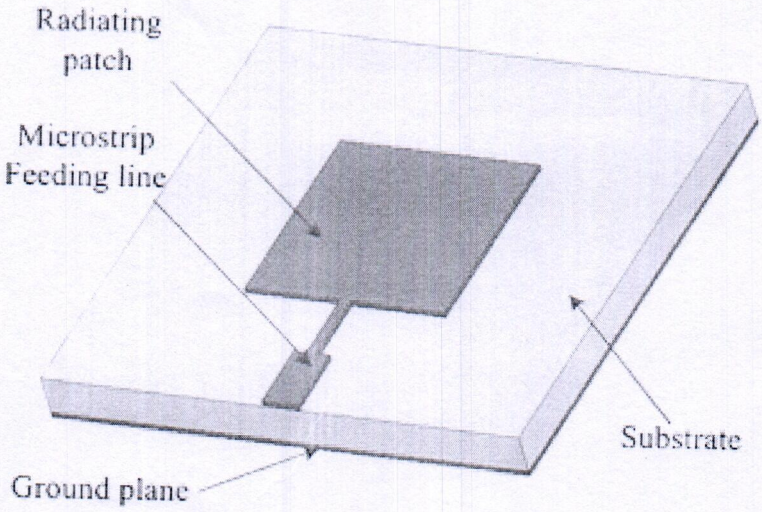

Fig. 1. Structure of MSA

In its most basic form, a Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side as shown in Fig. 1. The patch is generally made of conducting material such as copper or gold and can take any possible shape. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. Patch antennas find wide application in wireless communication for its various characteristics as small size, low cost and ease of manufacture [1]. The applications of planar antennas are in various fields such as in mobile communication, RFID applications, satellite and in the area of military.

Advantages and Disadvantages

Microstrip patch antennas are increasing in popularity for use in wireless applications due to their low-profile structure. Therefore they are extremely compatible for embedded antennas in handheld wireless devices such as cellular phones, pagers etc...The telemetry and communication antennas on missiles need to be thin and conformal and are often Microstrip patch antennas [2]. Another area where they have been used successfully is in Satellite communication. Some of their principal advantages are given below:

- Light weight and low volume.
- Low profile planar configuration which can be easily made conformal to host surface.

- Low fabrication cost, hence can be manufactured in large quantities.
- Supports both, linear as well as circular polarization.
- Can be easily integrated with microwave integrated circuits (MICs).
- Capable of dual and triple frequency operations.
- Mechanically robust when mounted on rigid surfaces.

Microstrip patch antennas suffer from a number of disadvantages as compared to conventional antennas. Some of their major disadvantages are given below:

- Narrow bandwidth
- Low efficiency
- Low Gain
- Extraneous radiation from feeds and junctions
- Poor end fire radiator except tapered slot antennas
- Low power handling capacity.
- Surface wave excitation

To overcome narrow bandwidth limitation several techniques have been proposed in literature.

BACKGROUND AND SIGNIFICANCE

Some antennas for multiband applications, such as U-slot [3], V-slot [4] and bow-tie slot [5] have been reported. A variety of techniques have been used to achieve multi band operation for planar antennas. A triple band frequency antenna is presented in [6]. This combines a dual band and mono band antennas with broadside directional pattern. A novel low cost triple-band circularly polarized antenna is presented in [7], which operates at 2.4 GHz, 3.5 GHz and 5.7 GHz bands. This antenna achieves frequency ratio which is suitable for multiband wireless co a linearly polarized compact multiband MIMO antenna system for small mobile unit is presented. In [8], a novel coplanar waveguide fed compact ultra-wide band (UWB) microstrip antenna is proposed for ultra-wide band applications. This antenna possessed a method to minimize the monopole antenna by loading of inverted L-strip over the conventional radiator patch antenna to lower the height of the antenna. The good impedance-matching characteristic and constant gain were achieved over entire operating bandwidth of 2.6–13.04 GHz (10.44 GHz). A compact four-element multiple-input–multiple-output (MIMO) antenna for portable wireless ultra-wide band (UWB) applications is presented in [9]. In [10], a dual-polarized slot antenna for ultra-wide band (UWB) applications is proposed. The measured impedance bandwidth is 120% (3.0–12 GHz).

Need of Multiband Antenna:

Nowadays different mobile communication systems have been designated with different frequency bands.

For example In China, the 2G systems, such as GSM900/GSM1800, CDMA, and PCS, operate in the 900 MHz (825–960 MHz) and 1800 MHz (1710–1920 MHz) bands 3G systems, such as TD-SCDMA, WCDMA, and cdma2000, operated in the 2GHz (1880–2170 MHz) band. The

future LTE (4G) systems will operate in the 2.3 GHz (2300–2400 MHz) and 2.6 GHz (2570–2690 MHz) bands. Therefore base station antennas should simultaneously cover two separated frequency bands

OBJECTIVES OF THE PROPOSED RESEARCH WORK

The proposed research work will involve the following points:

1) Study of various techniques to design multiband microstrip patch antenna for mobile communication.

2) Design and analysis of patch antenna for multiband operation suitable for mobile communication using software. To apply optimization techniques such as Genetic algorithm to optimize antenna parameters.

3) Design and analysis of compact microstrip patch antenna for ultra-wide band application suitable for wireless communication.

4) To fabricate the designed antenna and compare simulated results with measured results.

REASEARCH METHODOLOGY

The proposed work will be conducted on the ANSYS High Frequency Structural Simulator (HFSS). HFSS offers state-of the-art solver technologies based on finite element, integral equation and advanced hybrid methods to solve a wide range of microwave, RF and high-speed digital applications. It will involve the design of antenna, analysis of various characteristics parameters as return loss, VSWR and radiation pattern.

The proposed steps for the conduction of work are as follows:

(a) Brief literature review and theoretical study will be performed for primary requirements and general approaches to achieve UWB antenna.
(b) Different antenna shapes will be studied and designed on HFSS based on the requirement for UWB system.
(c) Parametric study of different design parameter will be carried out with the help of HFSS simulator to achieve desired performance and characteristics.
(d) To avoid interference various techniques for getting the band notch will be studied and implemented in the design.
(e) The optimum antenna design will be fabricated.
(f) The performance of fabricated design will be measured through VNA (Vector network analyzer)
(g) The comparative study will be carried out between simulated and measured result to get optimum results.

LIKELY OUTCOME OF THE PROPOSED RESEARCH WORK

Several multiband and ultra-wide band antennas will be designed, fabricated and tested.

The antennas will come in product form with simulated and measured results and will be ready for marketing.

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